

Michael J. Duoba

Mechanical Engineer, Center for Transportation Research
Energy Systems Division (ES)
Argonne National Laboratory (ANL)

Professional Experience:

5/97-present Mechanical Engineer
Center for Transportation Research, ES Division

Team leader for the Advanced Powertrain Research Facility. Oversaw the development of this state-of-the-art research facility from its inception to its current state as a multi-dynamometer, multi-technology test facility. Responsible for developing test protocols and data acquisition systems for engines, electric motors, and vehicles – technologies that have few standardized test procedures. Directed outside software consultants to develop standardized data acquisition code that is used in all the test cells. Developed fast, generic, and graphical post processing code that is modular and compatible with data acquisition software that performs many procedures and functions not available from off-the-shelf software. Invented the *in-situ* engine torque measurement method for providing data from advanced vehicles for internal model validation. This method is now being used by two automakers for model validation in developing new efficient powertrains and competitive vehicle data analysis. Responsible for generating the data Ford, GM, and DaimlerChrysler use as a standard for advanced vehicle test and analysis (Japan Toyota Prius, US Prius, and Honda Insight). Routinely consult with the California Air Resources Board and SAE on how to properly test hybrid electric vehicles.

2/93 – 5/97 Assistant Mechanical Engineer
Center for Transportation Research, ES Division

Technical Director of 1993 NGV Challenge, 1995 HEV Challenge, 1996-1999 FutureCar Challenges. Developed and wrote the competition rules encompassing technical and safety specifications of all major vehicle areas, including high-voltage drive systems, energy storage, mechanical systems, vehicle structure and body, and gaseous and liquid fuel systems. The current Advanced Vehicle Technology Competitions still use many of the rules that were developed from 1994-1999. Developed and administered over 100 hybrid electric vehicle (HEV) tests at dynamometer facilities at U.S. Environmental Protection Agency Ann Arbor, New York City Department of Environmental Protection, California Air Resources Board, Automotive Test Laboratories (Arizona and Ohio), Ford Motor Company, General Motors, and DaimlerChrysler providing an unequalled amount of practical experience in testing a wide variety of HEVs.

1/89 – 8/91 Co-Op Student
Advanced Battery Group, CMT Division

Fabricated advanced electric vehicle Li/FeS₂ battery cells and built special testing fixtures for life-cycle tests and area specific impedance (ASI) measurements.

Education:

M.S. Mechanical Engineering, University of Wisconsin-Madison, Madison, WI, 1993
B.S. Mechanical Engineering, Illinois Institute of Technology, Chicago, IL, 1991

Professional Society Activities:

Member of Society of Automotive Engineers and served as consultant to SAE standard J1711 HEV Test Procedure Task Force

Laboratory Committees:

Member of Transportation Technology R&D Center's "Transportation Workgroup"

Awards:

Honored in *Crain's Chicago Business* yearly feature "40 under 40" highlighting Chicago's most influential and successful younger professionals (2000).

Publications: Peer Reviewed Conference Papers

- Unless otherwise noted, papers are 8-15 pages in length.
- All publications are to report findings of DOE-sponsored work

Duoba, M., Ng, H. and Larsen, R., *Characterization and Comparison of Two Hybrid Electric Vehicles (HEVs) – Honda Insight and Toyota Prius*, SAE Paper 2001-01-1335, 2001 SAE International Congress & Exposition, Detroit, MI, 12 pgs. (2001).

Duoba, M., Ng, H. and Larsen; R., *In-Situ Mapping and Analysis of the Toyota Prius HEV Engine*, SAE Paper 2001-01-3096, SAE Future Transportation Conference, Costa-Mesa, CA, 8 pgs. (2000).

Duoba, M. and Larsen, R., *Investigation of Practical HEV Test Procedures with Prototypes from the 1997 FutureCar Challenge*, SAE Paper 981080, 1998 SAE International Congress & Exposition, Detroit, MI (1998).

Duoba, M., Larsen, R., LeBlanc, N., Design Diversity of HEVs with Example Vehicles from HEV Competitions, 1996 SAE International Congress & Exposition, Detroit, MI 10 pgs., (1996).

Duoba, M., et. al, *Testing Hybrid Electric Vehicle Emissions and Fuel Economy at the 1994 U.S. Department of Energy/Society of Automotive Engineers HEV Challenge*, 1995 SAE International Congress and Exposition (1995).

Duoba, M. and Larsen, R., *HEV Dynamometer Testing with State-of-charge Correction in the 1995 HEV Challenge*, SAE Paper 960740, 1996 SAE International Congress & Exposition 8 pgs., (1996).

Rousseau A., Duoba, M., Deville, B., Kern, J., and Ng, H., *Honda Insight Validation Using PSAT*, SAE Paper 2001-01-2538, SAE Future Transportation Technology Conference & Exposition, (August 2001).

Ng, H., Duoba, M., Anderson, J., and Larsen, R., *Engine Starting Characteristics of Two Hybrid Electric Vehicles (HEVs) - Honda Insight and Toyota Prius*, SAE Paper 2001-01-2492, Future Transportation Technology Conference & Exposition, (August 2001).

Kaun, T. D., Duoba, M., Gillie, K. R., Simon, D. R., and Vissers, D. R., *Li-alloy/FeS₂ as a Sealed Bipolar Battery*, Proceedings of the International Power Sources Symposium, Proceedings of the 34th International Power Sources Symposium, (1991)

Kaun, T.D., Duoba, M., Johll, W.P., Luong, V., Mrazek, F.C., Palkon, D.J., and Simon, D.R., *Development of Prototype Sealed Bipolar Lithium/Sulfide Cells*, Proceedings of the 26th Intersociety Energy Conversion Engineering Conference - IECEC '91, Volume: 3, (1991).

Kaun, T. D., J., Duoba, M., Gillie, K. R., Hash, M. C., Simon, D. R., and Vissers, D. R., *Development of a Sealed Bipolar Li-alloy/FeS₂ Battery for Electric Vehicles*, Proceedings of the 25th Intersociety Energy Conversion Engineering Conference - IECEC '90, Volume: 3, (1990).

Publications: Conference Papers (approved by a conference committee)

Duoba, M., Anderson, J., and Ng, H., *Issues in Emissions Testing of Hybrid Electric Vehicles*, Proceedings of the 2000 Global Powertrain Congress, Detroit, MI, 14 pgs., (2000).

Duoba, M., *Comparisons of the Latest HEV Test Procedures*, SAE/NESEA Workshop on Hybrid Electric Vehicles, Albany, NY (May 1999).

Duoba, M., *Challenges for the Vehicle Tester in Testing Hybrid Electric Vehicles*, 7th Annual CRC On-Road Vehicle Emissions Workshop, San Diego, CA (1997).

Duoba, M., Quong, S., LeBlanc, N., Buitrago, C., Larsen R., *Performance of Electric and Hybrid Electric Vehicles at the 1995 American Tour de Sol*, NESEA Conference, Boston, MA, 6 pgs., (1995).

Duoba, M., McDowell, K., and Ruiz, F., *NGV Challenge 1991 at the Illinois Institute of Technology*, International Congress and Exposition, (1992).

Turner, L., Duoba, M., Larsen, R., McBroom, S., Nedungadi, A., and Wipke, K, *Modeling Future Automobiles: The Role of Industry and Government*, COMPEL - The International Journal for Computation and Mathematics in Electrical and Electronic Engineering, Volume: 19, 9 pgs., (2000).

Buitrago, C., Duoba, M., and Larsen, R., *1997 Propane Vehicle Challenge: summary of results*, Proceedings of the 1998 SAE International Congress & Exposition, SAE Special Publications, Volume: 1360, (1998).

Sluder, S., Duoba, M., and Larsen, R., *Evaluation of High-Energy-Efficiency Powertrain Approaches: The 1996 FutureCar Challenge*, Proceedings of the 1997 International Congress and Exposition, SAE Special Publications, Volume: 1234, (1997).

Pasquier, M., Duoba, M., Rousseau, A., *Validating Simulation Tools for Vehicle System Studies Using Advanced Control and Testing Procedures*, 18th International Electric Vehicle Symposium (EVS18), Berlin, Germany, 12 pgs. (2001).

Publications: Other Reports and Documents

Duoba, M., LeBlanc, N., Quong, S., and Buitrago, C., *1999 FutureCar Challenge Rules and Regulations*, Rules and Technical Specifications for FutureCar Challenge, (1999).

Duoba, M., LeBlanc, N., Quong, S., and Buitrago, C., *1998 FutureCar Challenge Rules and Regulations*, Rules and Technical Specifications for FutureCar Challenge, 69 pgs., (1998).

Duoba, M., LeBlanc, N., Quong, S., and Buitrago, C., *1997 FutureCar Challenge Rules and Regulations*, Rules and Technical Specifications for FutureCar Challenge, 71 pgs. (1997).

Duoba, M., Sluder, S., Larsen, R. P., *1997 Hybrid Electric Vehicle Specifications*, ANL Technical Memo ANL/ESD/TM-136, 62 pgs., (1996).

Duoba, M., LeBlanc, N., Quong S., and Buitrago, C., *1996 FutureCar Challenge Rules and Regulations*, Rules and Technical Specifications for FutureCar Challenge, 85 pgs., (1996).

Oral Presentations:

Duoba, M., *Assessment of Japanese Hybrid Production Vehicles: Performance Issues*, presentation requested by the National Academy of Engineering as part of their yearly PNGV Review, Southfield Michigan (Feb. 2001).

Duoba, M., *Honda Insight Testing at Argonne National Laboratory*, presented to the California Air Resources Board, El Monte, CA, (Nov. 2000).

Duoba, M., *Honda Insight Testing at Argonne National Laboratory*, presented to the Honda North America, Torrance, CA, (Nov. 2000).

Duoba, M., *Comparison of the Latest HEV Test Procedures*, presented at Northeast Sustainable Energy Association Workshop on Hybrid Electric Vehicles, Albany, NY (May 1999).

Duoba, M., *Operation and Controls of The Toyota Prius*, presented to distinguished representatives from auto industry responding to need to study just-released Toyota Prius, "Prius Modeling Meeting", USCAR Headquarters, Southfield, MI, 71-slides, 5-hour presentation (June 1999).

Duoba, M., *HEV Test Procedure Issues*, presented to test engineers at the California Air Resources Board, El Monte, CA (Aug. 2001).

Duoba, M., et., al. *The High-Performance Hybrid: A Viable Option in US Market?* presented at the SAE FTT, Costa Mesa, CA (Aug. 2000).

Duoba, M. and Larsen, R.P., *Argonne National Laboratory's HEV Research Program*, presented to PSA Peugeot Citroen HEV development team, Paris, France (Feb. 2000).

Duoba, M., et. al, *In-Situ Mapping and Analysis of the Toyota Prius HEV Engine* presented to SAE FTT conference, Costa Mesa, CA (Aug. 2000).

Duoba, M., Rousseau, A., *ANL's Work with PSAT and Plans for Hardware In the Loop* presented to Mutasim Salman of GM, chair of PNGV Systems Analysis Technical Team, ANL (Aug. 1999).

Duoba, M., *Fundamentals of EVs: Mounting Issues* presented at the Northeast Sustainable Energy Association's Annual Conference, New York, NY (July 1997).

Duoba, M., *Operational Characteristics of the First Mass-Produced HEV – The Toyota Prius* presented at Workshop on Hybrid Electric Vehicles, Albany, NY (May 1999).

Duoba, M., Larsen, R.P, Pasquier, M. *Heavy Vehicle System Analysis at ANL* presented to DOE Sponsors in the Office of Heavy Vehicle Technology (Aug. 2000).

Duoba, M., *Hybrid Electric Vehicles, PNGV, and ANL Research Program* Presented to IEEE Chicago Section meeting, Chicago, IL (Feb. 2000).

Duoba, M. *ANL Systems Analysis Program* presented at AVL, Detroit, MI, July 7, 2000.

Duoba, M., *Using Forward Modeling of Hybrid Electric Vehicles with PSAT and PSAT-PRO* presented to University of California-Davis hybrid vehicle development team, Davis, California (Oct. 2000).

Duoba, M., *Vehicle Systems & Fuels Highlight: Advanced Powertrain Test Facility* presented at the Energy Systems Division Review, ANL (Dec. 2000).

Duoba, M., *DOE OAAT Objectives Achieved With Future ANL Testing Activities*, presented to DOE Merit Review of ANL Systems Analysis Program, USCAR Headquarters, Southfield, MI (April 2001).

Duoba, M., *Advanced Powertrain Test Facility*, presented for the DOE Merit Review of ANL Systems Analysis Program, USCAR Headquarters, Southfield, MI (Dec. 2000).

Duoba, M., *Vehicle Systems & Fuels Highlight: Advanced Powertrain Test Facility*, presented to visitors from Dow Chemical, ANL (June 2001).

Duoba, M., *ANL Systems Analysis Program Project: Potential of SIDI in HEVs, Efficiency and Emissions*, work proposal presented to Ro Sullivan, DOE SIDI Sponsor, Washington D.C. (Jan. 2001).

Duoba, M., *Bettering CIDI Vehicle Efficiency Using a Low-Emissions SI Engine System with Waste Heat Recovery*, ANL LDRD proposal presented to ES Division management, ANL (July 2001).

Duoba, M., Larsen, R.P, Hardy, K., Rousseau, A., Pasquier, M., *Argonne's Hybrid Electric Vehicle Technology Development Program* presented to International Truck and Engine Company proposing joint research, Melrose Park, IL (June 2001).

Duoba, M., *Prius and Insight Analysis and Comparison*, presented to Transportation Technology R&D Center's "Transportation Workgroup," ANL (Feb. 2001).

Duoba, M., *Review of Advanced Powertrain Test Facility (APTF) DOE Systems Analysis Merit Review*, USCAR Headquarters, Southfield, MI (March 2002).

Duoba, M. and Larsen R. P., *Do EVs Measure Up?* Presented to SAE Chicago Section Meeting, Darien, IL (Feb. 1995).